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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/714,243	11/13/2003	Bomy Chen	2102397-992740	2456

26379 7590 01/08/2007  
DLA PIPER RUDNICK GRAY CARY US, LLP  
2000 UNIVERSITY AVENUE  
E. PALO ALTO, CA 94303-2248

EXAMINER
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NGUYEN, DAO H

ART UNIT	PAPER NUMBER
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2818

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/08/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

**Office Action Summary**

Application No.

10/714,243

Applicant(s)

CHEN ET AL.

Examiner

Dao H. Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 19 October 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1,4,5,8-11,14-16,18 and 19 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,4,5,8-11,14-16,18 and 19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

### DETAILED ACTION

1. This Office Action is in response to the communications dated 09/12/2006 through 10/19/2006.

Claims 1, 4, 5, 8-11, 14-16, 18, 19 are active in this application.

Claim(s) 2-3, 6-7, 12-13, 17, and 20-24 have been cancelled.

### Remarks

2. Applicant's argument(s), filed 09/12/2006 have been fully considered, but are moot in view of new ground of rejection(s).

### Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. **Claim(s) 1, 4, 5, 8-11, 14-16, 18, 19 are rejected under 35 U. S. C. § 102 (b) as being anticipated by U.S. Patent No. 6,040,210 to Burns Jr. et al..**

Regarding claim 1, Burns discloses a non-volatile memory cell, as shown in figs. 8-11, comprising:

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a substantially single crystalline substrate 235 of a first conductivity type (p-type, col. 8, lines 31-34) having a planar surface;

a trench 210 in said planar surface, said trench 210 having a side wall and a bottom;

a floating gate 265 in said trench 210 spaced apart and insulated from said sidewall and from said bottom (by insulating material 260/250/280); said floating gate 265 having a tip (top portion) away from said bottom;

a first region 215 of a second conductivity type in said bottom;

a second region 240 of a second conductivity type along said planar surface, spaced apart from said first region 215;

a channel region between said first region 215 and said second region 240, said channel region only along said sidewalls, said floating gate 265 spaced apart and along said entire channel region;

a control gate 275 capacitively coupled to said floating gate 265 and capable of effecting erase; and

a tunnel material 270 between said tip and said control gate 275, wherein said tunnel material 270 is a tunnel oxide and configured to permit Fowler-Nordheim tunneling of charges from said floating gate 265 to said control gate 275 (col. 15, lines 28-35).

Regarding claim 4, Burns discloses the memory cell further comprising an insulation material 260 between said floating gate 265 and said sidewall of said trench

210, said insulation material 260 permitting injection of hot channel electrons from said channel region to said floating gate 265. See col. 3, lines 1-14; col. 15, lines 28-35.

Regarding claim 5, Burns discloses an array of non-volatile memory cells in a substantially single crystalline substrate 235 of a first conductivity type (p-type substrate) having a planar surface, as shown in figs. 8-11, 15-16, 53-72, said array comprising:

- a plurality of discontinuous trenches 210 in said planar surface, spaced apart and substantially parallel to one another extending in a first direction (fig. 8); each of said discontinuous trenches 210 having two sidewalls and a bottom and being discontinuous in said first direction by a plurality of isolations, each of said discontinuous trenches 210 having a plurality of sections separated by an isolation;

- a first (left) floating gate 265 (figs. 10-11) in each trench spaced apart and insulated from a first sidewall and from said bottom (by insulating material 260/250/280); said first floating gate 265 having a tip (top portion of floating gate 265) away from said bottom;

- a second (right) floating gate 265 in each trench spaced apart and insulated from a second sidewall and from said bottom; said second floating gate having a tip (top portion of floating gate 265) away from said bottom;

- a first region 215 of a second conductivity type in said bottom of each trench 210;

- a second region 240 of said second conductivity type along said planar surface;

a channel region between each of said first region 215 and said second region 240, said channel region only along said first and second sidewall;

a first contact 460 in a first trench 210 electrically connected to said first region 215 of a first section and electrically connected to said first region of a second section of said first trench (figs. 15-16, 53-72);

a plurality of control gates 275, each control gate 275 extending in a second direction, substantially perpendicular to said first direction, extending over a plurality of tips of a plurality of floating gates 265 and insulated therefrom (by oxide layer 270); and

a tunnel material 270 between said plurality of tips and said control gate 275, wherein said tunnel material 270 is a tunnel oxide and configured to permit Fowler-Nordheim tunneling of charges from said floating gate 265 to said control gate 275 (col. 15, lines 28-35).

Regarding claim 8, Burns discloses the array further comprising an insulation material 260 between said first (left) floating gate 265 and said first sidewall of said trench 210, said insulation material 260 permitting injection of hot channel electrons from said channel region to said first floating gate 265. See col. 3, lines 1-14; col. 15, lines 28-35.

Regarding claim 9, Burns discloses the array further comprising said insulation material 260 between said second (right) floating gate 265 and said second sidewall of said trench, said insulation material 260 permitting injection of hot channel electrons

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from said channel region to said second floating gate 265. See col. 3, lines 1-14; col. 15, lines 28-35.

Regarding claim 10, Burns discloses a non-volatile memory device in a substantially single crystalline substrate 235 of a first conductivity type (p-type substrate) having a planar surface, as shown in figs. 8-11, 15-16, 53-72, said device comprising:

- an array of non-volatile memory cells 205 arranged in a plurality of rows and columns (fig. 8); wherein each cell comprising:

- a trench 210 in said planar surface, said trench 210 having a side wall and a bottom;

- a floating gate 265 in said trench 210 spaced apart and insulated from said sidewall and from said bottom; said floating gate 265 having a tip (top portion of floating gate 265) away from said bottom;

- a first region 215 of a second conductivity type in said bottom;

- a second region 240 of a second conductivity type along said planar surface, spaced apart from said first region 215;

- a channel region between said first region 215 and said second region 240, said channel region only along said sidewall;

- a control gate 275 spaced apart from said tip and capacitively coupled to said tip;

and

a tunnel material 270 between said tip and said control gate 275, wherein said tunnel material 270 is a tunnel oxide configured to permit Fowler-Nordheim tunneling of charges from said floating gate 265 to said control gate 275 See col. 3, lines 1-14; col. 15, lines 28-35; and

wherein cells in adjacent columns share a common trench 210 to one side and a common second region 240 to another side (fig. 11);

wherein cells in adjacent rows are separated by an isolation row and wherein said second region in one row is connected to said second region of another row (figs. 15-16, 64, 70);

wherein a first cell in a first row includes a first contact 460 in said trench electrically connected to said first region 215/405 of said first cell (figs. 15-16, 53-72) and wherein said first contact is electrically connected to said first region of a second cell in a second row separated from said first row by at least one isolation row; and

wherein said control gate 275 of cells in the same row are connected together.

Regarding claim 11, Burns discloses the device wherein a control gate extends over a plurality of rows. See figs. 8-11, 15-16, 53-72.

Regarding claims 14-15, Burns discloses the device comprising all claimed limitations. See col. 3, lines 1-14; col. 15, lines 28-35.



Regarding claim 16, Burns discloses a non-volatile memory device, as shown in figs. 8-11, 15-16, 53-72, comprising:

a plurality of non-volatile memory cells 205 arranged in a plurality of rows and columns (fig. 8); each cell having a first terminal 215, in a trench 210, and second terminals 240, not in a trench, with a channel region therebetween only along a sidewall of the trench 210, a floating gate 265 spaced apart and insulated from said channel region along said sidewall of the trench 210, a control gate 275 capacitively coupled with said floating gate 265, and a tunnel material 270 between said floating gate 265 and said control gate 275 configured to permit Fowler-Nordheim tunneling of charges from said floating gate 265 to said control gate 275 to effect erasure (col. 15, lines 28-35); a coupling gate 460 capacitively coupled to the floating gate 265 and electrically connected to said first terminal 215;

wherein said cells 205 in the same row are connected with each cell having a common second terminal 240 with an adjacent cell to one side, and having a common first terminal 215 and a common coupling gate with an adjacent cell to another side (figs. 8-11, 15-16, 53-72);

wherein cells in the same row have the control gate 275 connected together; and  
wherein cells in adjacent rows are separated by isolation (figs. 8-11, 15-16, 53-72).

Regarding claim 18, Burns discloses the device wherein said floating gate 265 of cells in the same row are capacitively coupled to the same control gate. See figs. 8-11, 15-16, 53-72.

Regarding claim 19, Burns discloses the device wherein cells in the same column have the same first terminal 215 and the same second terminal 240. See figs. 8-11, 15-16, 53-72.

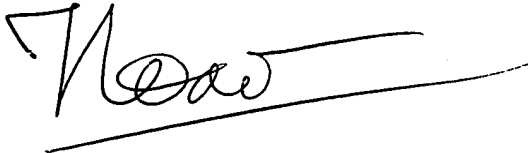
### **Conclusion**

5. A shortened statutory period for response to this action is set to expire 3 (three) months and 0 (zero) day from the day of this letter. Failure to respond within the period for response will cause the application to become abandoned (see M.P.E.P 710.02(b)).

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dao H. Nguyen whose telephone number is (571)272-1791. The examiner can normally be reached on Monday-Friday, 9:00 AM – 6:00 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith, can be reached on (571)272-1907. The fax numbers for all communication(s) is 571-273-8300.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (571)272-1625.

A handwritten signature in black ink, appearing to read 'Dao', with a long horizontal line extending to the right.

Dao H. Nguyen  
Art Unit 2818  
December 27, 2006